

IR-03 Pilot Study Update

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BCT Meeting

Hunters Point Naval Shipyard

April 24, 2014

Location: HPNS IR03



HPNS IR03 – Overview



•Nonaqueous phase liquid (NAPL) Treatment Pilot Study (NTPS):

Activity	Schedule
In Situ Thermal Remediation (ISTR) Operation	February 4 – May 30, 2014
ISTR Performance Soil and Groundwater Sampling	June 2014
In Situ Solidification/Stabilization (ISS) Design – Draft to BCT	April 30, 2014
BCT Review ISS Design and Submit Comments	May 14, 2014
Submit RTCs and Final ISS Design	June 4, 2014
Begin ISS Mixing Pilot	June 9, 2014

In Situ Thermal Heating

ISTR System



Observations Reported at the Last BCT Meeting



- As of 3/18/2014:
 - 345,000 gallons of water had been recirculated.
 - 890 gallons of NAPL had been extracted.
- Significant amounts of NAPL were still being extracted.
 - We were in the process of incorporating VGAC and LGAC data into the LNAPL production
 - TO-15 data was in the process of validation
- Operations will continue with temperatures ramping up to boiling.
- Criteria for shutting down ISTR system:
 - Cessation of NAPL recovery/point of diminishing returns
 - Pore volumes recirculated with no NAPL recovery



ISTR System Operation: New NAPL Separation Tank

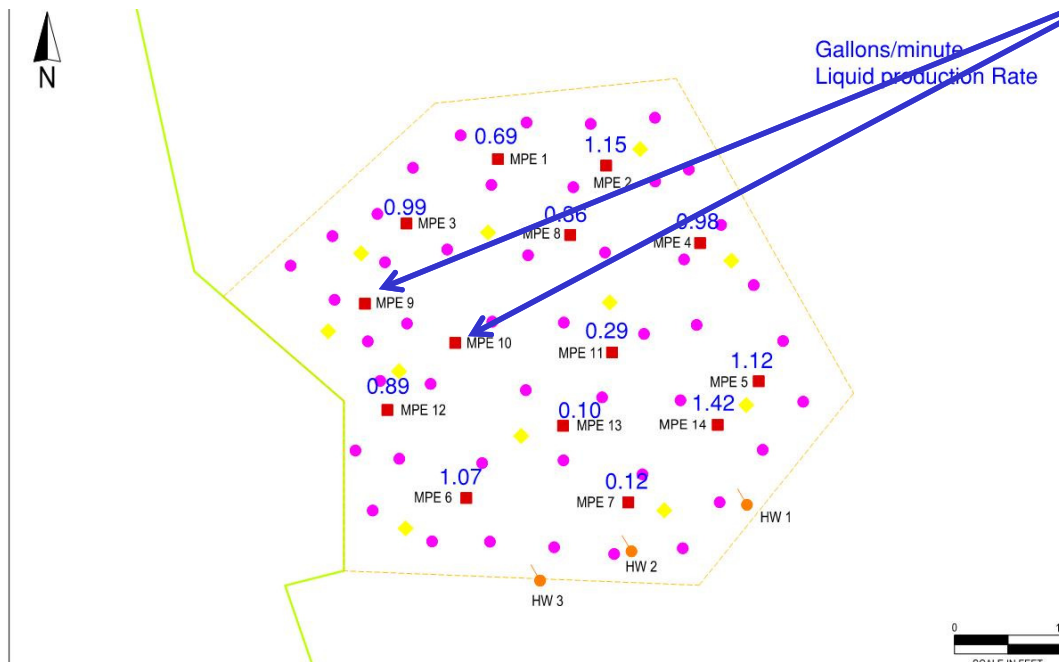


- Old- 1000 gallon NAPL Separator
- Large volumes of NAPL required longer retention for phase separation.



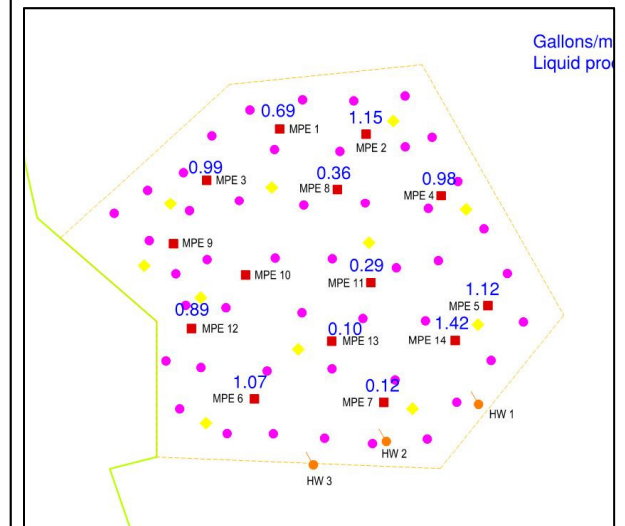
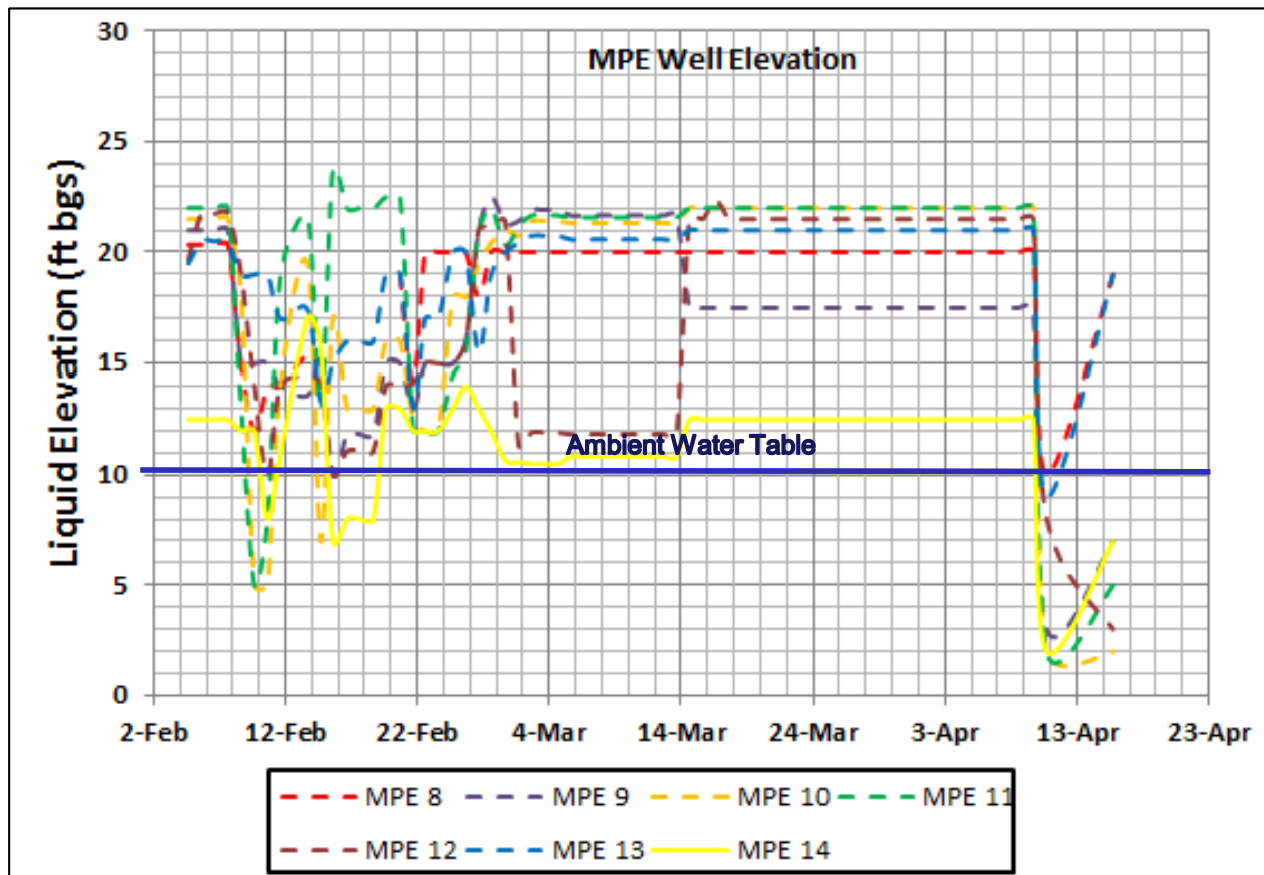
- New- 10,000 gallon NAPL Separator
- Resolution on NAPL measurements= 50 gallons.

Hydraulic Control: April 2014



- Well MPE 9 and 10 are dry
- Internal MPE locations are pumping at lower rates with greater drawdown
- Pumping at a total rate of approximately 10,000 – 25,000 gal/day
- Total pumped volume up to approximately 526,000 gallons through 04/09/14
- Turned off exterior MPE points to try and flush water through the interior of the system

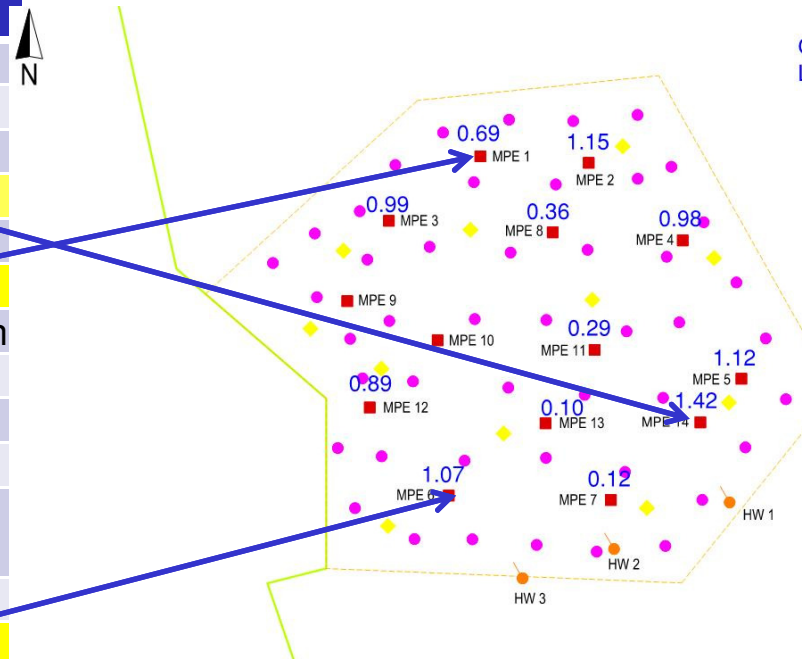
Hydraulic Control: April



Testing of Individual MPE Wells



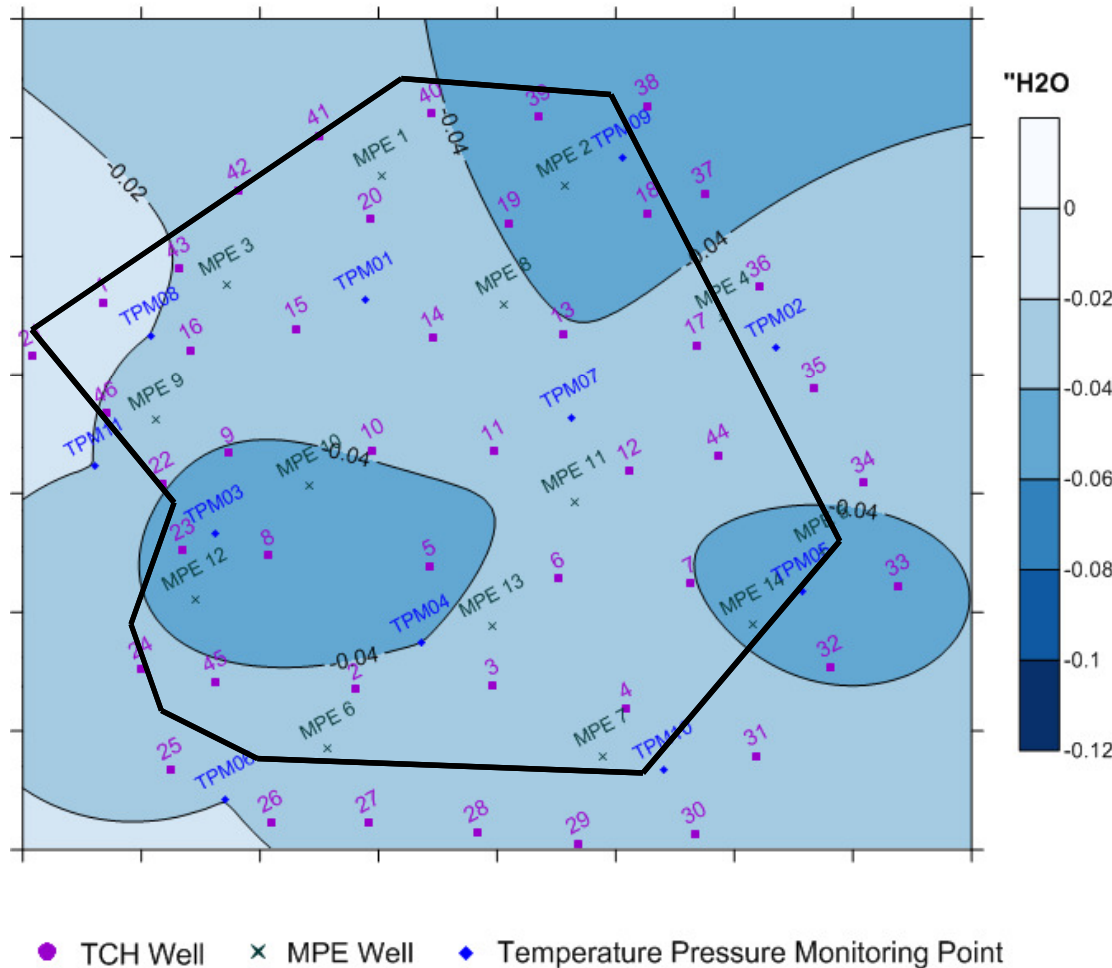
Well ID	Depth (feet)	Production Rate (gal/min)	Notes
4	10.5	0.98	small sheen of oil around rim
2	11	1.15	dirty water, little oil but no sheen
5	6	1.12	sheen over surface
14	9	1.42	2mm thick oil on top
11	25	0.29	dirty oil water mix
1	12	0.69	1mm oil sheen
8	20	0.36	oil water mix with spots of sheen
3	7	0.99	clean water with slight oil sheen
10	NA	0.00	
13	20	0.10	shiny oil on top of water
12	6	0.89	sheen over whole surface oil water mix
9	NA	0.00	
6	12	1.07	2mm thick oil on top
7	18	0.12	little bit of sheen



Pneumatic Control: April

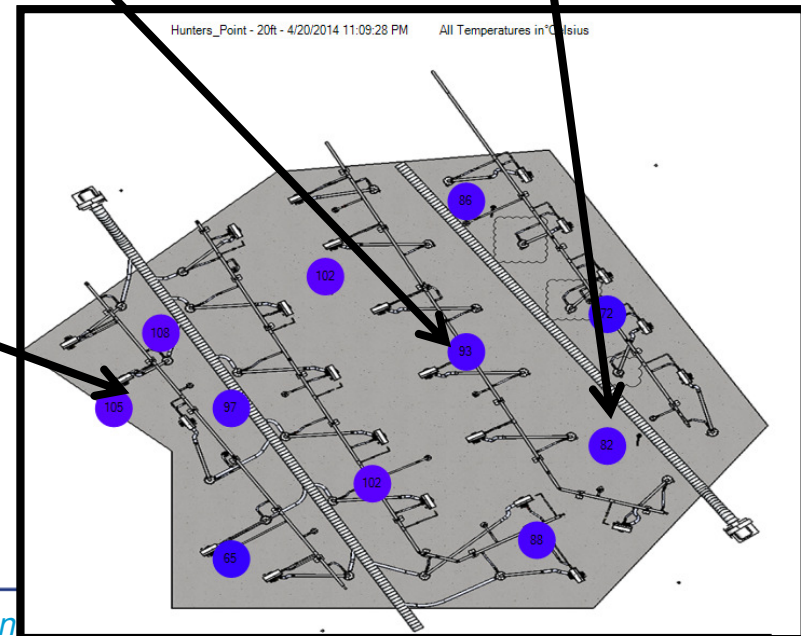
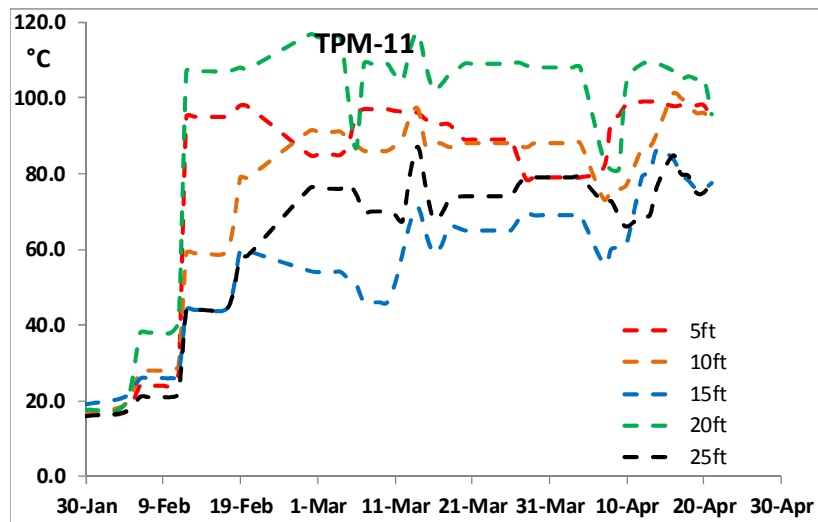
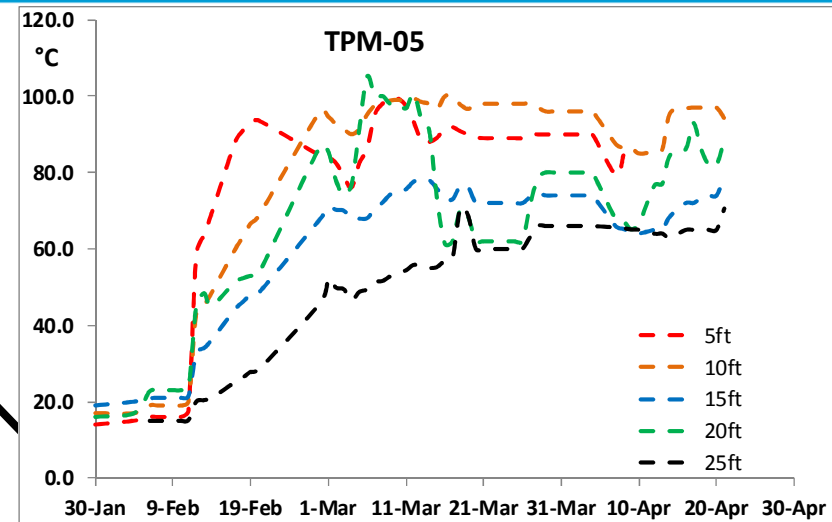
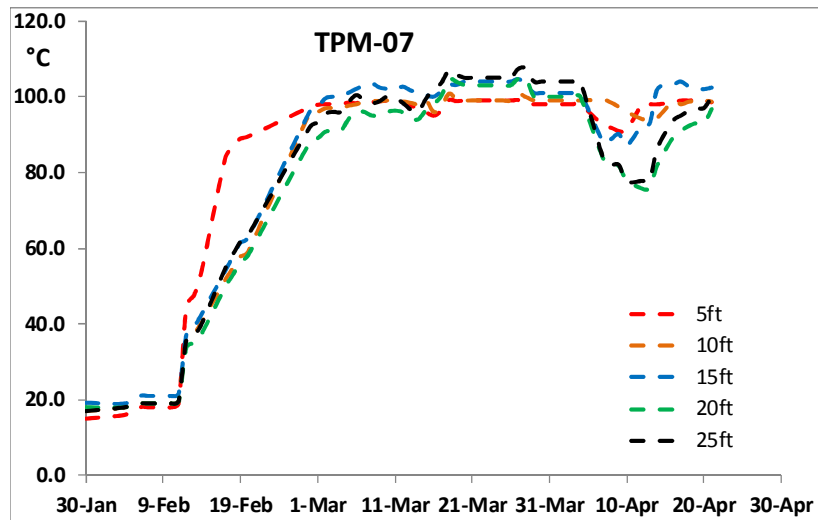


Vacuum Contour Map - 04/17/2014



- Pressures within the system are low; pneumatic control is maintained.

Temperatures in Treatment System



Proposed Shutdown Criteria



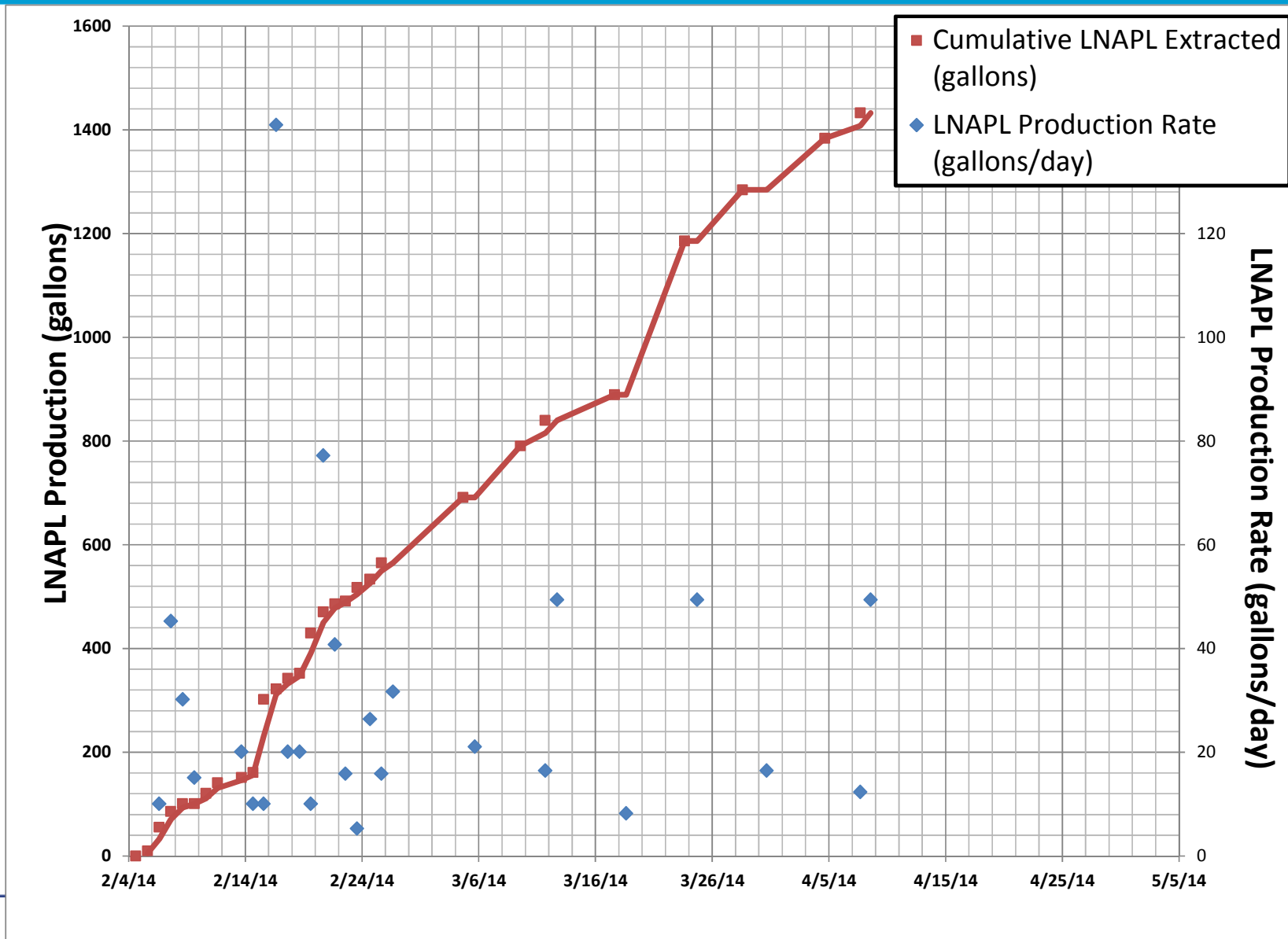
Proposed Shutdown criteria: at least 1 pore volume (150,000 gallons) recirculated with no measureable NAPL accumulation (< 50 gallons)

–Pore Volume = 150,000 gallons

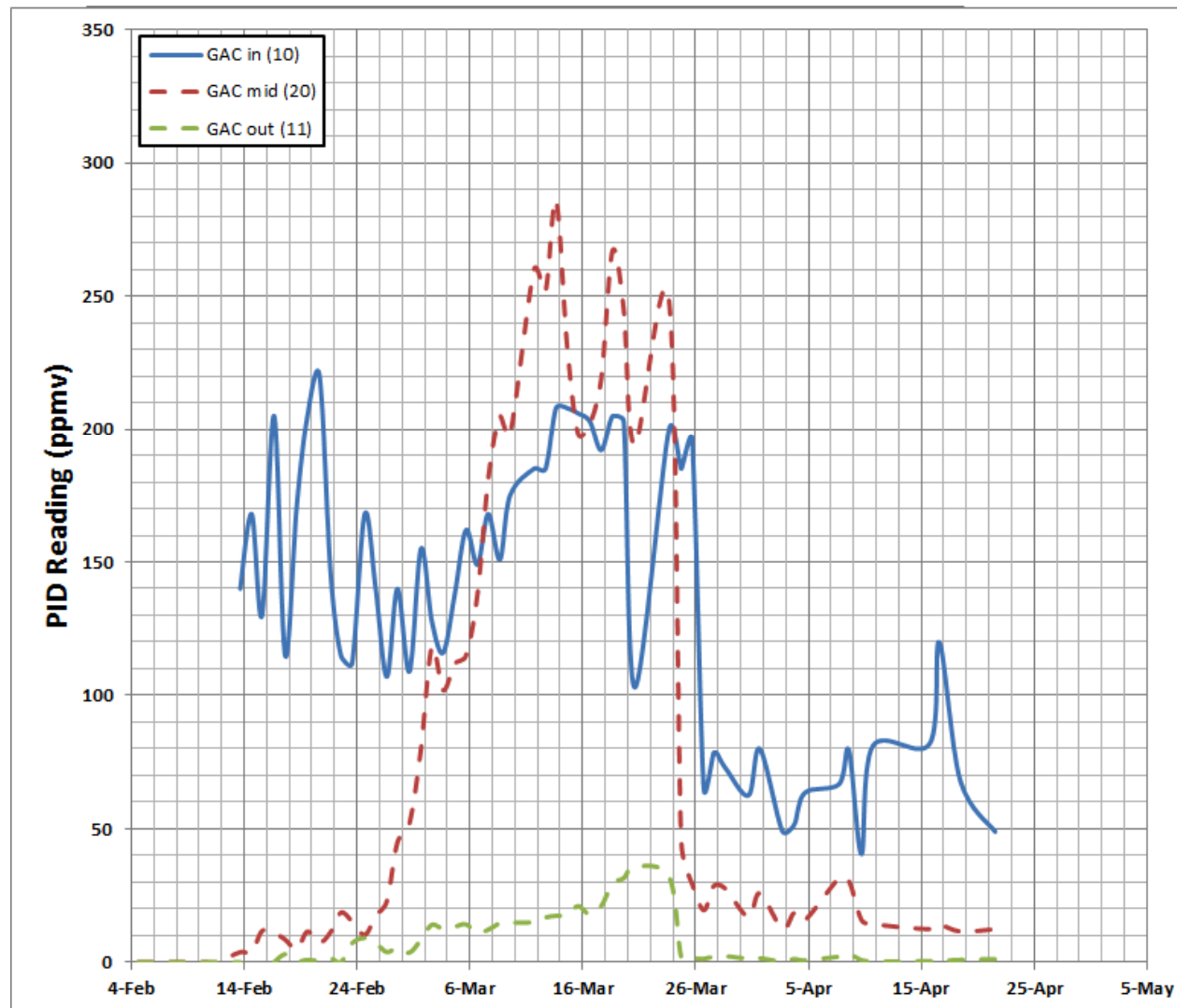
- Heated volume 7,260 yd³
- Porosity 0.42

–As of April 9 (64 days of operations), flushed ~3.5 pore volumes through the system.

NAPL Production



GAC Treatment of Vapor-phase Contaminants



VGAC Effluent TO-15 Detections



Sample Date	Analyte	Result	Flag
2/14/14	Acetone	2.5	J
	Isopropanol	0.4	J
	n-Hexane	0.19	J
	cis-1,2-Dichloroethene	0.056	J
	2-Butanone	0.63	J
	Tetrahydrofuran	0.76	
	Benzene	0.094	J
	Trichloroethene	0.4	J
	Toluene	0.25	J
	Tetrachloroethene	0.053	J
	m,p-Xylenes	0.22	J
	Naphthalene	0.66	J
3/14/14	Chloromethane	1100	
	Bromomethane	6.6	J
	Chloroethane	160	
	Trichlorofluoromethane	7.1	J
	Carbon Disulfide	51	
	Methylene Chloride	61	
	1,1-Dichloroethane	2.2	J
	cis-1,2-Dichloroethene	15	
	Cyclohexane	25	
	Tetrachloroethene	59	
4/15/14	Chloromethane	620	
	Vinyl Chloride	0.3	J
	Acetone	0.9	J
	Isopropanol	0.5	J
	n-Hexane	0.21	J
	cis-1,2-Dichloroethene	0.18	J
	2-Butanone	0.16	J
	Benzene	0.09	J
	Trichloroethene	0.22	J
	Toluene	0.33	J
	Tetrachloroethene	1.5	

4/24/2014

ISTR Summary

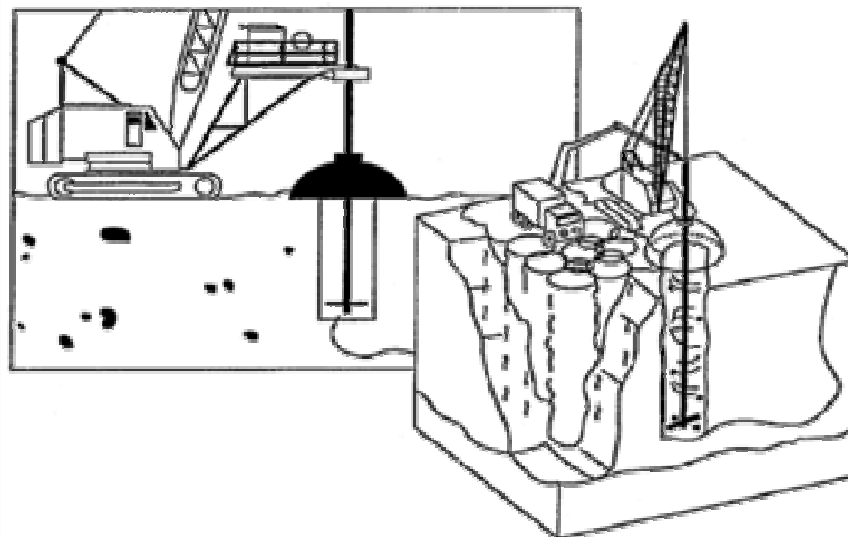
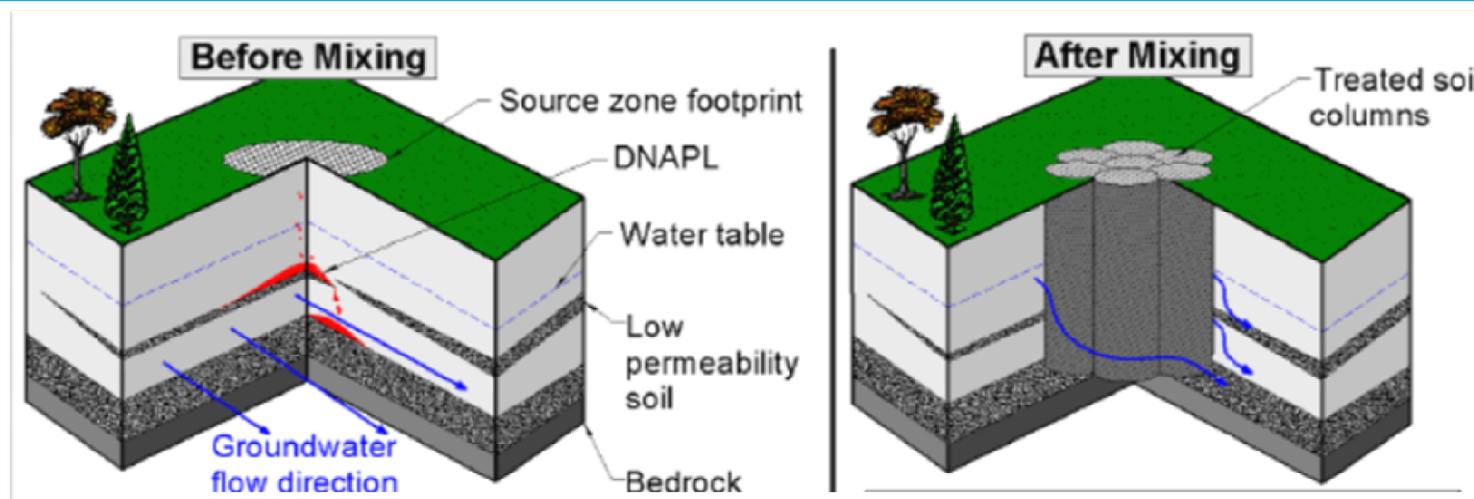


- As of 4/7/14:
 - 1432 gallons of NAPL removed
 - 526,000 gallons of water recirculated.
- MPE wells 8, 9, 10, 11, 12 will be operated and the other (perimeter) MPE wells will be shut off.
- Reinjection rates will be reduced to 5,000 to 10,000 gallons/day, and adjusted, as necessary.
- Criteria for shutting down ISTR system:
 - Cessation of NAPL recovery
 - 1 pore volumes (150,000 gallons) recirculated with no measureable NAPL recovery (< 50 gallons).
 - Estimated to be ~15 days of operations.



In Situ Stabilization/Solidification

ISS Design



ISS Design: Bench Study Results



- **Phase 1 – Initial Screening**

- **A baseline Mix was selected from nine soil-reagent mixtures**

- Reagents evaluated were cement, fly-ash and lime
 - Mixtures evaluated for hydraulic conductivity and cost

- **Baseline Composite consisted of**

- Treatment Zone Composite
 - 30% (w/w) Bay Mud
 - 18% (w/w) Bentonite Slurry
 - 20% (w/w) cement

- **Phase 2 – Synthetic Precipitation Leaching Procedure (SPLP) for Selected Mixture**

- **Evaluated leachability with 2 additive products**

- Additive Products: Organoclay and Activated Carbon

- **Addition of Organoclay did not improve the reduced leaching of the baseline mix**

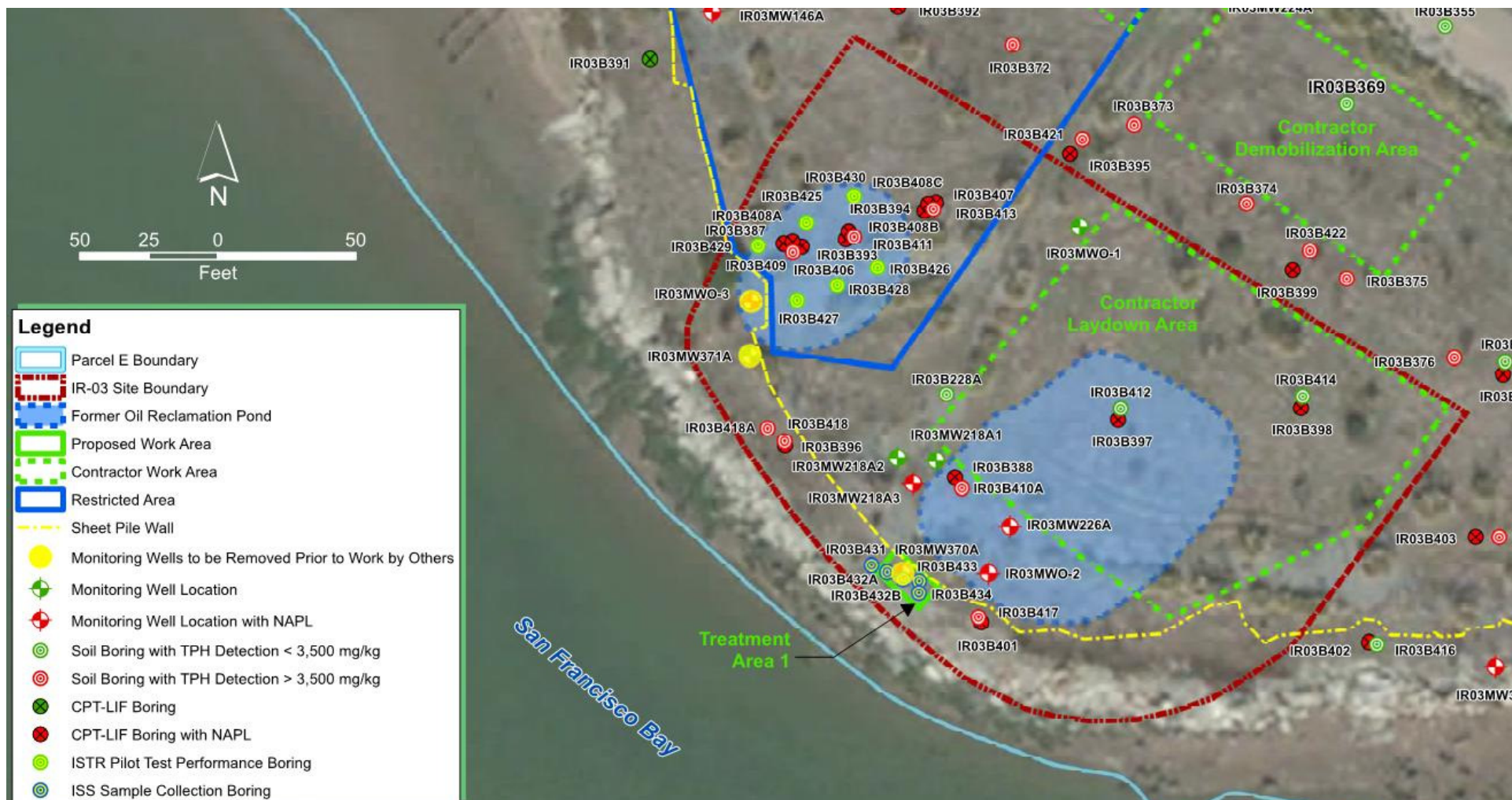
- **Addition of activated carbon did improve leaching but not significantly**

Phase 3:Semi-dynamic Leaching Test



Parameter	units	Aquatic Criteria	2 hr	24 hr	48 hr	72 hr	7 day	14 day	28 day	42 day	Blank Leaching Fluid
GRO	µg/L	1400	<300	<300	<300	<300	<300	<300	NA	NA	NA
DRO	µg/L	1400	<210	<160	<110	<150	<100	<100	NA	<96	NA
MRO	µg/L	1400	<210	<160	<110	<150	<100	<100	NA	280J	NA
TOC	mg/L	-	2.2	2.9	4.2	3.9	3.2	2.9	NA	1.8	NA
Sb	µg/L	-	<50	<50	<50	27	<50	<50	<250	<250	<250
Ba	µg/L	-	22	19	5.1	4.4	3.9	2.9	20	<33	<33
Ca	mg/L	-	92	54	33	58	16	<50	24	15	54
Cu	µg/L	28	15	14	4.9	11	7.2	<14	<68	<68	<68
Mg	mg/L	-	560	540	570	560	540	580	510	520	510
Mn	µg/L	-	3.4	<7.5	<7.5	<7.5	<7.5	<7.5	<38	<38	<38
Ni	µg/L	96.5	9.2	10	<12	<12	5.6	5.2	21J	<60	<60
K	mg/L	-	310	350	220	300	240	250	250	230	200
Na	mg/L	-	5400	5400	5400	5300	6000	6000	5600	5000	4800
Cd	µg/L	-	<3	<3	<3	<3	<3	<3	6.3J	<15	<15
Pb	µg/L	14.4	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	26J	<26	<26
Zn	µg/L	81	<100	<100	<100	<100	<100	<100	930J	<500	<500
PCB 1260	µg/L	0.03	<0.6	0.36	<0.52	<0.57	<0.43	<0.61	NA	NA	NA
3&4 methylphenol	µg/L	-	3.2	5.1	<6	<6	5.6	<6	NA	NA	NA
1 methyl naphthalene	µg/L	-	<3.4	1.3	<6	<6	<6	<6	NA	NA	NA
dimethyl phthalate	µg/L	-	<3.4	<3.2	<6	<6	2.9	<6	NA	NA	NA
inorganic carbon	mg/L	-	NA	NA	110	120	NA	95	NA	9.1	NA

Pilot Study Area



Pilot Study Design

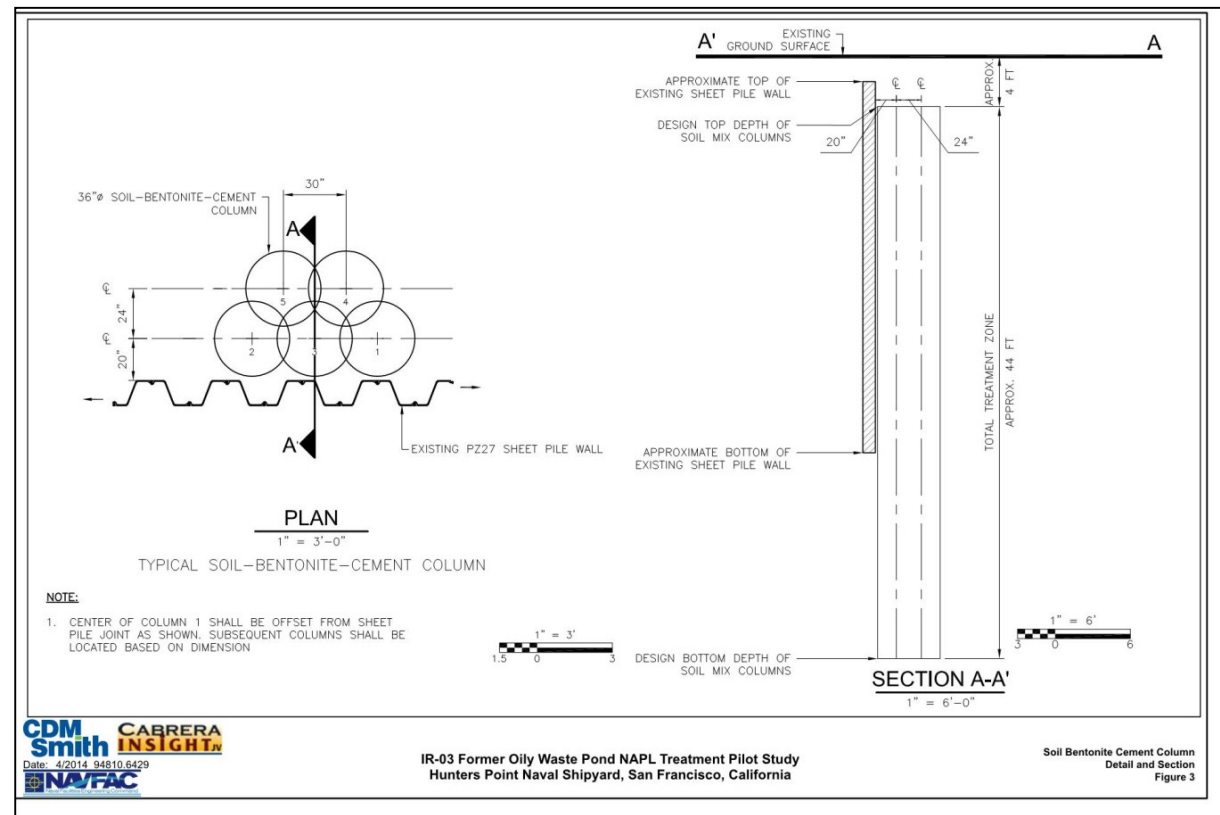


- **Mix Specification:**

- 20 feet Treatment Zone Soils
- 30% (w/w) Bay Mud (20 feet)
- 18% (w/w) Bentonite Slurry
- 20% (w/w) cement.

- **5 soil columns:**

- Extend to 48 feet
- 36 inch diameter augers
- 30 inches center-to-center to create a 6-inch column overlap,
- second row of columns will be installed with a 24-inch column-to-column center.



ISS Summary



- Requesting an expedited (2-week) review of the Design Document
- Field work scheduled June 9

